Biomedical Engineering

Chair: Jianyi Zhang, MD, PhD

Associate Chair of Education: Alan Eberhardt, PhD

Degree Offered	Bachelor of Science in Biomedical Engineering
Accreditation	The Bachelor of Science in Biomedical Engineering degree program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the commission's General Criteria and Program Criteria for Bioengineering and Biomedical and Similarly Named Engineering Programs.
Website	https://www.uab.edu/engineering/bme/undergraduate
Program Director	Alan Eberhardt, PhD
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Biomedical engineering (BME) is the application of engineering principles and technology to the solution of problems in the life sciences and medicine. Biomedical engineers create knowledge and develop technologies that improve healthcare delivery and patient outcomes with an emphasis on reducing healthcare costs. Graduates create and apply knowledge at the interface of life sciences and engineering for the benefit of society. The BME undergraduate program prepares graduates to be immediately productive and able to adapt to a rapidly changing environment. In addition to the Blazer Core, the curriculum includes engineering core courses, mathematics, calculus-based physics, biology, chemistry, humanities, social and behavioral sciences, biomedical engineering core courses and electives. The curriculum culminates in a capstone design experience where student teams apply knowledge to solve real-world engineering problems. A bachelor's degree in BME from UAB provides a foundation in biomedical implants and devices, biomaterials, biocomputing, biotransport, and biomedical instrumentation to compete in an increasingly technical medical field, and also prepares students for graduate school, medical school, or professional school.

Vision

To be an internationally recognized, research-oriented Department of Biomedical Engineering: a top choice for undergraduate and graduate education.

Mission

The Department of Biomedical Engineering provides leadership in teaching the principles of engineering and biology and in conducting research that will translate new discoveries in biological engineering science to the fields of public health and clinical medicine. These efforts will enable us to identify new solutions to critical challenges in health care and the life sciences.

Program Educational Objectives

Graduates of the Biomedical Engineering undergraduate program will have:

1. Gained admission to graduate or professional school, or gained employment in engineering and/or health related professions and
2. Pursued opportunities for professional growth, development, and service

Student Outcomes

Upon completion of the BSBME degree program, our graduates will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Academic Warning, Probation, and Readmission

BME students must maintain an institutional (UAB) GPA of at least 2.50. First-term BME freshmen students who have an institutional GPA below 2.50 will be placed on academic warning in BME. If their institutional GPA is not at least 2.50 after the next term enrolled, they will be placed on academic probation in BME. BME undergraduates (other than first-term freshmen) who do not have an institutional GPA of at least 2.50 will be placed on BME academic probation. If at the end of the next term in which they enroll, their institutional GPA is not at least 2.50, they will be reclassified as Undeclared Engineering. To be re-admitted to the BME program, a student must have an institutional GPA of at least 3.00 and make a formal application for readmission.

Program and Graduation Requirements

BME students must have an institutional GPA of at least 2.50 and have completed at least 64 hours of coursework applicable to their degree before they may register for 300-level and 400-level BME courses. BME students must also have an institutional GPA of 2.50 or higher and have earned a grade of C or better in all BME courses to graduate.

Please note the Residency Requirement on the Majors tab.

Please refer to the School of Engineering Overview for School policies related to admission, reasonable progress requirements, and graduation.

Non-Majors Enrolled in BME Coursework

In addition to fulfilling course prerequisites, non-BME students (including students seeking a BME minor) who wish to enroll in 300-level and 400-level BME courses must have an institutional (UAB) GPA of at least 3.00

or permission of the BME Undergraduate Program Director. Non-BME majors may not enroll in BME 423, BME 498, or BME 499.

BME Minors

Please refer to the Minors tab on the School of Engineering's Overview page in this catalog for information specific to BME minors.

Bachelor of Science in Biomedical Engineering

Major in Biomedical Engineering

Requirements		Hours
Blazer Core Requirements		43
CH 115 & 115R & CH 116	General Chemistry I and General Chemistry I Recitation and General Chemistry I Laboratory	
EGR 103	Computer Aided Graphics and Design	
EGR 200	Introduction to Engineering [1]	
EH 101	English Composition I	
EH 102	English Composition II	
MA 125 & 125L	Calculus I and Calculus I Lab	
PH 221 & 221L & 221R	General Physics I and General Physics Laboratory I and General Physics I Recitation	
PH 222 & 222L & 222R	General Physics II and General Physics Laboratory II and General Physics II - Recitation	
Academic Foundations: Reasoning		
Thinking Broadly: History & Meaning		
Thinking Broadly: Creative Arts		
Thinking Broadly: Humans & Their Societies		
City as a Classroom [2]		
Other Required Courses		**70**
BME 310	Biomaterials	
BME 210	Engineering in Biology	
BME 312	Biocomputing	
BME 313	Bioinstrumentation	
BME 333	Biomechanics of Solids	
BME 350	Biological Transport Phenomena	
BME 370	Integrated Physiology	
BME 401	Undergraduate Biomedical Engineering Seminar	
BME 423	Living Systems Analysis and Biostatistics	
BME 498	Capstone Design I Product Development	
BME 499	Capstone Design II	
BY 115 & 115L	Human Anatomy and Human Anatomy Laboratory	
or BY 210 & 210L	Genetics and Genetics Laboratory	
BY 123 & 123L	Introductory Biology I and Introductory Biology I Laboratory	
CE 210	Statics	
CH 117 & 117R & CH 118	General Chemistry II and General Chemistry II Recitation and General Chemistry II Laboratory	
EE 312	Electrical Systems	
EGR 150	Computer Methods in Engineering	
EGR 194	Engineering Explorations	
EGR 265	Math Tools for Engineering Problem Solving [3]	
MA 126	Calculus II	
MA 260	Introduction to Linear Algebra	
ME 215 & 215R	Dynamics and Dynamics Recitation	
MSE 280	Engineering Materials	
Biomedical Engineering Electives		**9**
BME 221	Clinical Innovation I	
BME 289	Undergraduate Research in Biomedical Engineering I [4]	
BME 389	Undergraduate Research in Biomedical Engineering II [4]	
BME 424	Current Topics in Stem Cell Engineering	
BME 435	Tissue Engineering	
BME 443	Medical Image Processing	
BME 444	Machine Learning for Biomedical Engineering Applications	
BME 450	Computational Neuroscience	
BME 462	Cardiac Electrophysiology	
BME 471	Continuum Mechanics of Solids	
BME 489	Undergraduate Research in Biomedical Engineering III [4]	
BME 490	Special Topics in Biomedical Engineering	
BME 491	Individual Study in Biomedical Engineering [5]	
BME 494	Honors Research I [5, 6]	
Engineering/Math/Science Electives [7]		**6**
Select six credit hours from the following or from the list of Biomedical Engineering electives above		
BY 271 & 271L	Biology of Microorganisms and Biology of Microorganisms Laboratory	
BY 311	Molecular Genetics	
BY 330	Cell Biology	
BY 362	Neurobiology	
CE 337	Hydraulics	
CE 345	Transportation Engineering	
CE 360	Structural Analysis	
CE 395	Engineering Economics	
CE 420	Advanced Mechanics	
CE 433	Solid and Hazardous Wastes Management	
CH 235 & 235R	Organic Chemistry I and Organic Chemistry I Recitation	
CH 237 & 237R	Organic Chemistry II and Organic Chemistry II Recitation	
CH 355	Quantitative Analysis	
CH 460	Fundamentals of Biochemistry	
MA 313	Patterns, Functions and Algebraic Reasoning	
MA 360	Scientific Programming	
MA 361	Mathematical Modeling	
MA 453	Fourier Analysis	
MA 485	Probability	
ME 360	Introduction to Mechatronic Systems Engineering	
ME 370	Kinematics and Dynamics of Machinery	
ME 371	Machine Design	
ME 464	Introduction to Finite Element Method	
MSE 281 & 281L	Physical Materials I and Physical Materials I Laboratory	
MSE 380	Thermodynamics of Materials	
MSE 401	Materials Processing	
MSE 430 & 430L	Polymeric Materials and Polymeric Materials Laboratory	
NBL 355	Synapses, Neurons and Brains	

NBL 356	Mechanisms of Sensation, Movement & Cognition	
PH 475	Introduction to Biophysics I	
PH 487	Nanoscale Science and Applications	
RHB 400	Introduction to Rehabilitation Science	
Total Hours		**128**

1 EGR 200 preferred; other FYE courses accepted

2

3 May substitute MA 227 and MA 252 for EGR 265 and one BME/Engineering/Math/Science Elective

4 A maximum of 3 hours of combined credit from BME 289, BME 389, and/or BME 489 may be applied to the degree

5 With approval of the BME Undergraduate Program Director; a maximum of 3 hours of BME 491 or BME 494 may be used for elective credit

6 Student must be enrolled in BME Honors Program

7 Other elective courses may be selected with the approval of the BME Undergraduate Program Director

Residency Requirement

In addition to UAB's residency requirement, to earn a Bachelor of Science in Biomedical Engineering from UAB, the BME department requires that students complete the following courses at UAB:

Requirements		Hours
BME 423	Living Systems Analysis and Biostatistics	3
BME 498	Capstone Design I Product Development	3
BME 499	Capstone Design II	3
Additional 400-level BME Elective		3
Total Hours		**12**

Concentration in Biomechanics

Students seeking the degree of BSBME may add a concentration in Biomechanics by appropriate selection of their Mathematics/Science/Engineering Electives (3 credit hours), Engineering Elective (3 credit hours), and BME Electives (6 credit hours).

Requirements		Hours
BME 471	Continuum Mechanics of Solids	3
ME 464	Introduction to Finite Element Method	3
RHB 490	Quantitative Biomechanics of Injury and Rehabilitation	3
Total Hours		**9**

Concentration in Biomaterials/Tissue Engineering

Students seeking the degree of BSBME may add a concentration in Biomaterials/Tissue Engineering by appropriate selections of their Mathematics/Science/Engineering Elective (3 credit hours), Engineering Elective (3 credit hours), and BME Electives (6 credit hours).

Requirements		Hours
Required Courses		**9**
Select three of the following:		
BME 420	Implant-Tissue Interactions	
BME 435	Tissue Engineering	
MSE 281	Physical Materials I	
Elective Courses		**3**
Select one of the following:		
BY 311	Molecular Genetics	
BY 330	Cell Biology	
BY 431	Principles of DNA Technology	
MSE 381	Physical Materials II	
MSE 382	Mechanical Behavior of Materials	
MSE 401	Materials Processing	
MSE 408	Nanobiomaterials	
MSE 413	Composite Materials	
MSE 430	Polymeric Materials	
MSE 464	Metals and Alloys	
MSE 470	Ceramic Materials	
PH 487	Nanoscale Science and Applications	
Total Hours		**12**

Curriculum for the Bachelor of Science in Biomedical Engineering (BSBME)

Freshman

First Term	Hours	Second Term	Hours
CH 115 & 115R & CH 116^	4	BY 123 & 123L	4
EGR 200[1]	3	CH 117 & 117R & CH 118	4
EH 101[%]	3	EGR 103[#]	3
MA 125 & 125L[*]	4	EGR 194	1
		MA 126	4
	14		**16**

Sophomore

First Term	Hours	Second Term	Hours
BY 210 & 210L	4	BME 210	3
EGR 265[2]	4	CE 210	3
MA 260	3	EE 312	3
PH 221 & 221L & 221R^	4	EGR 150	3
MSE 280	3	PH 222 & 222L & 222R^	4
	18		**16**

Junior

First Term	Hours	Second Term	Hours
BME 310	3	BME 333	3
BME 312	3	BME 350	3
BME 313	3	BME 423	3
BME 370	3	Biomedical Engineering Elective	3
ME 215	3	EH 102[%]	3
		Blazer Core: Creative Arts[5]	3
	15		**18**

Senior

First Term	Hours	Second Term	Hours
BME 401[3]	1	BME 499	3

BME 498	3	Biomedical Engineering Elective	3
BME Elective	3	Blazer Core: History & Meaning[5]	3
MA / SCI / EGR / BME Elective[2,4]	3	Blazer Core: City as a Classroom[$]	3
MA / SCI / EGR / BME Elective[4]	3	Blazer Core: Reasoning[5]	3
Blazer Core: Humans & Their Societies[5]	3		
	16		**15**

Total credit hours: 128

1 EGR 200 preferred; other FYE courses accepted
2 May substitute MA 227 and MA 252 for EGR 265 and one BME/ Engineering/Math/Science Elective
3 Seminar may be taken during any semester
4 Students using this curriculum as a pre-health professional program (pre-med, pre-dental, or pre-optometry) may use CH 235 or CH 237 or CH 460 for this elective
5 Please refer to the Blazer Core as specified for engineering majors
^ Satisfies Blazer Core: Scientific Inquiry
% Satisfies Blazer Core: Writing
# Satisfies Blazer Core: Communicating in the Modern World
* Satisfies Blazer Core: Quantitative Literacy
$ CE 280 preferred; other CAC courses accepted